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ON Semiconductor
NJL4281DG

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# NJL4281D (NPN)
# NJL4302D (PNP)

## Complementary ThermalTrak™ Transistors

The ThermalTrak family of devices has been designed to eliminate thermal equilibrium lag time and bias trimming in audio amplifier applications. They can also be used in other applications as transistor die protection devices.

### Features

- Thermally Matched Bias Diode
- Instant Thermal Bias Tracking
- Absolute Thermal Integrity
- High Safe Operating Area
- Pb−Free Packages are Available*

### Benefits

- Eliminates Thermal Equilibrium Lag Time and Bias Trimming
- Superior Sound Quality Through Improved Dynamic Temperature Response
- Significantly Improved Bias Stability
- Simplified Assembly
  - Reduced Labor Costs
  - Reduced Component Count
- High Reliability

### Applications

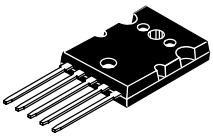
- High−End Consumer Audio Products
  - Home Amplifiers
  - Home Receivers
- Professional Audio Amplifiers
  - Theater and Stadium Sound Systems
  - Public Address Systems (PAs)

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

**ON Semiconductor®**

**http://onsemi.com**

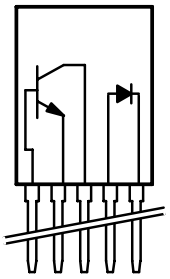
**BIPOLAR POWER TRANSISTORS**
**15 AMP, 350 VOLT, 230 WATT**



**TO−264, 5 LEAD**
**CASE 340AA**
**STYLE 1**

**MARKING DIAGRAM**


**SCHEMATIC**



NJLxxxxD = Device Code
xxxx = 4281 or 4302
G = Pb−Free Package
A = Assembly Location
YY = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| NJL4281D | TO−264 | 25 Units / Rail |
| NJL4281DG | TO−264 (Pb−Free) | 25 Units / Rail |
| NJL4302D | TO−264 | 25 Units / Rail |
| NJL4302DG | TO−264 (Pb−Free) | 25 Units / Rail |

# NJL4281D (NPN) NJL4302D (PNP)

**MAXIMUM RATINGS** ($T_J$ = 25°C unless otherwise noted)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector−Emitter Voltage | $V_{CEO}$ | 350 | Vdc |
| Collector−Base Voltage | $V_{CBO}$ | 350 | Vdc |
| Emitter−Base Voltage | $V_{EBO}$ | 5 | Vdc |
| Collector−Emitter Voltage − 1.5 V | $V_{CEX}$ | 350 | Vdc |
| Collector Current − Continuous<br>− Peak (Note 1) | $I_C$ | 15<br>30 | Adc |
| Base Current − Continuous | $I_B$ | 1.5 | Adc |
| Total Power Dissipation @ $T_C$ = 25°C<br>Derate Above 25°C | $P_D$ | 230<br>1.84 | W<br>W/°C |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{stg}$ | − 65 to +150 | °C |
| DC Blocking Voltage | $V_R$ | 200 | V |
| Average Rectified Forward Current | $I_{F(AV)}$ | 1.0 | A |

**THERMAL CHARACTERISTICS**

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction−to−Case | $R_{\theta JC}$ | 0.54 | °C/W |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Pulse Test: Pulse Width = 5 ms, Duty Cycle < 10%.

**ATTRIBUTES**

| Characteristic | | Value |
|---|---|---|
| ESD Protection | Human Body Model<br>Machine Model | >8000 V<br>> 400 V |
| Flammability Rating | | UL 94 V−0 @ 0.125 in |

# NJL4281D (NPN) NJL4302D (PNP)

**ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | |
| Collector Emitter Sustaining Voltage ($I_C$ = 50 mA, $I_B$ = 0) | $V_{CE(sus)}$ | 350 | – | Vdc |
| Collector Cut−off Current ($V_{CE}$ = 200 V, $I_B$ = 0) | $I_{CEO}$ | – | 100 | μAdc |
| Collector Cutoff Current ($V_{CB}$ = 350 Vdc, $I_E$ = 0) | $I_{CBO}$ | – | 50 | μAdc |
| Emitter Cutoff Current ($V_{EB}$ = 5.0 Vdc, $I_C$ = 0) | $I_{EBO}$ | – | 5.0 | μAdc |
| **SECOND BREAKDOWN** | | | | |
| Second Breakdown Collector with Base Forward Biased ($V_{CE}$ = 50 Vdc, t = 1.0 s (non−repetitive)) ($V_{CE}$ = 100 Vdc, t = 1.0 s (non−repetitive)) | $I_{S/b}$ | 4.5<br>1.0 | –<br>– | Adc |
| **ON CHARACTERISTICS** | | | | |
| DC Current Gain ($I_C$ = 100 mAdc, $V_{CE}$ = 5.0 Vdc) ($I_C$ = 1.0 Adc, $V_{CE}$ = 5.0 Vdc) ($I_C$ = 3.0 Adc, $V_{CE}$ = 5.0 Vdc) ($I_C$ = 5.0 Adc, $V_{CE}$ = 5.0 Vdc) ($I_C$ = 8.0 Adc, $V_{CE}$ = 5.0 Vdc) ($I_C$ = 15 Adc, $V_{CE}$ = 5.0 Vdc) | $h_{FE}$ | 80<br>80<br>80<br>80<br>40<br>10 | 250<br>250<br>250<br>250<br>–<br>– | – |
| Collector−Emitter Saturation Voltage ($I_C$ = 8.0 Adc, $I_B$ = 0.8 Adc) | $V_{CE(sat)}$ | – | 1.0 | Vdc |
| Emitter−Base Saturation Voltage ($I_C$ = 8.0 Adc, $I_B$ = 0.8 A) | $V_{BE(sat)}$ | – | 1.4 | Vdc |
| Base−Emitter ON Voltage ($I_C$ = 8.0 Adc, $V_{CE}$ = 5.0 Vdc) | $V_{BE(on)}$ | – | 1.5 | Vdc |
| **DYNAMIC CHARACTERISTICS** | | | | |
| Current−Gain − Bandwidth Product ($I_C$ = 1.0 Adc, $V_{CE}$ = 5.0 Vdc, $f_{test}$ = 1.0 MHz) | $f_T$ | 35 | – | MHz |
| Output Capacitance ($V_{CB}$ = 10 Vdc, $I_E$ = 0, $f_{test}$ = 1.0 MHz) | $C_{ob}$ | – | 600 | pF |
| Maximum Instantaneous Forward Voltage (Note 2) ($i_F$ = 1.0 A, $T_J$ = 25°C) ($i_F$ = 1.0 A, $T_J$ = 150°C) | $v_F$ | 1.1<br>0.93 | | V |
| Maximum Instantaneous Reverse Current (Note 2) (Rated dc Voltage, $T_J$ = 25°C) (Rated dc Voltage, $T_J$ = 150°C) | $i_R$ | 10<br>100 | | μA |
| Maximum Reverse Recovery Time ($i_F$ = 1.0 A, di/dt = 50 A/μs) | $t_{rr}$ | 100 | | ns |

2. Diode Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

# NJL4281D (NPN) NJL4302D (PNP)

## TYPICAL CHARACTERISTICS

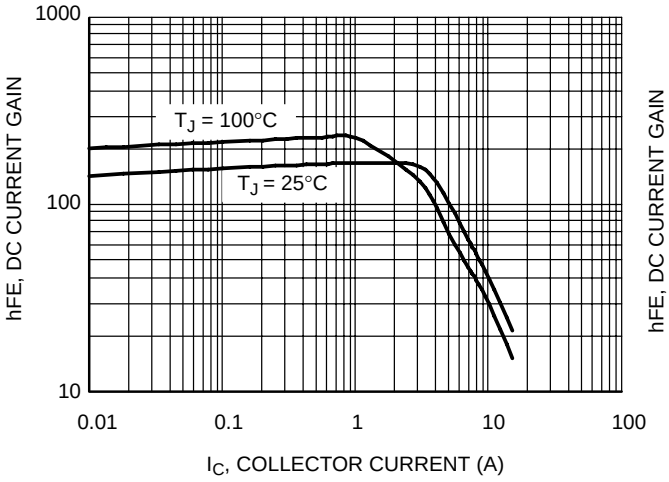



**Figure 1. DC Current Gain, $V_{CE}$ = 5 V, NPN NJL4281D**

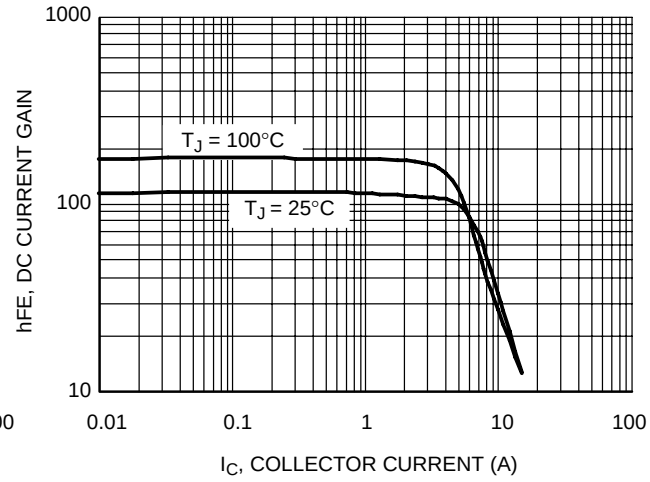



**Figure 2. DC Current Gain, $V_{CE}$ = 5 V, PNP NJL4302D**

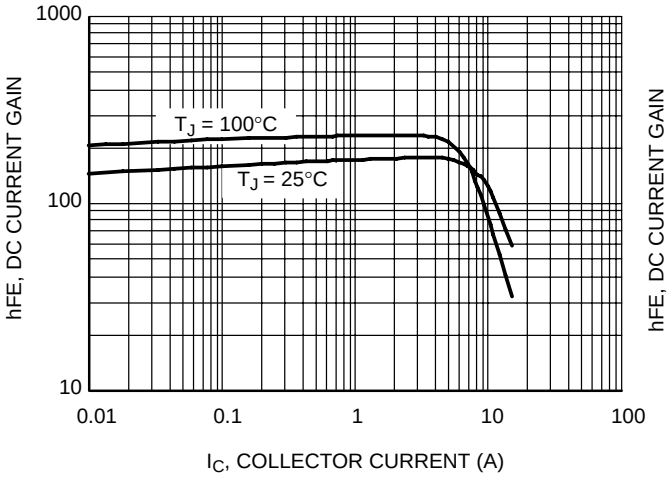



**Figure 3. DC Current Gain, $V_{CE}$ = 20 V, NPN NJL4281D**

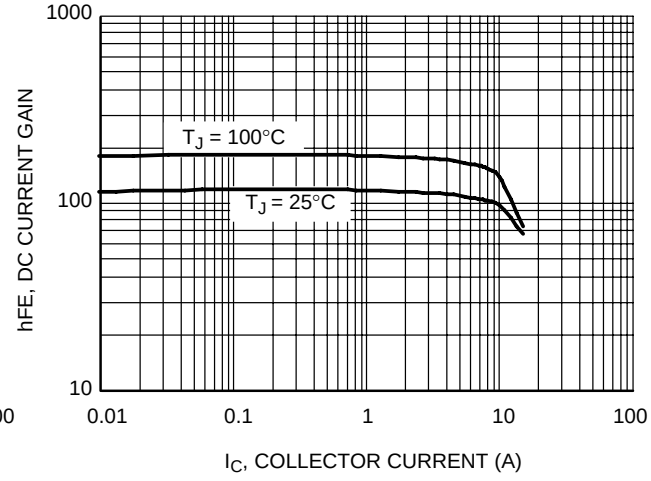



**Figure 4. DC Current Gain, $V_{CE}$ = 20 V, PNP NJL4302D**

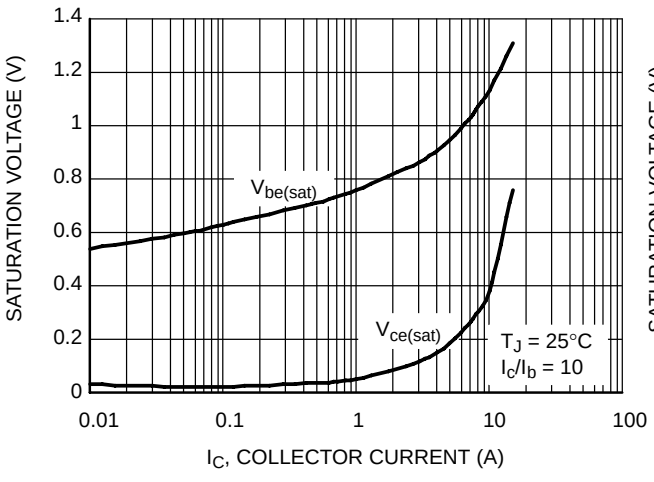



**Figure 5. Typical Saturation Voltage, NPN NJL4281D**

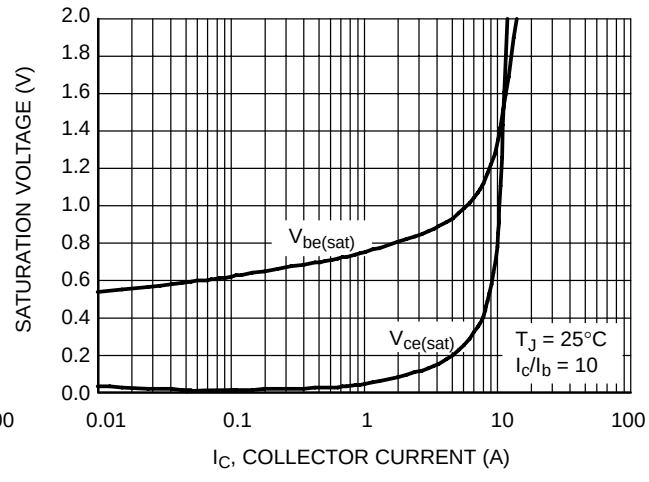



**Figure 6. Typical Saturation Voltage, PNP NJL4302D**

## NJL4281D (NPN) NJL4302D (PNP)

### TYPICAL CHARACTERISTICS

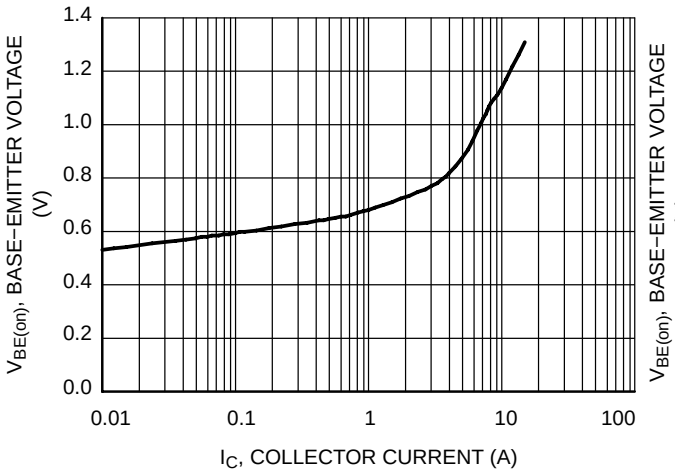



**Figure 7. Typical Base−Emitter Voltages, NPN NJL4281D**

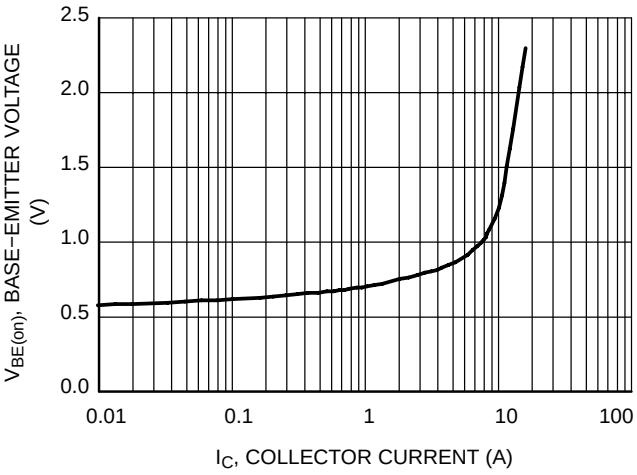



**Figure 8. Typical Base−Emitter Voltages, PNP NJL4302D**

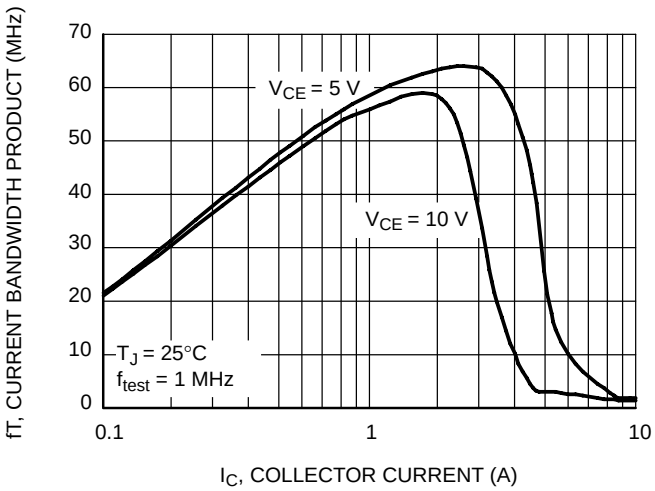



**Figure 9. Typical Current Gain Bandwidth Product, NPN NJL4281D**

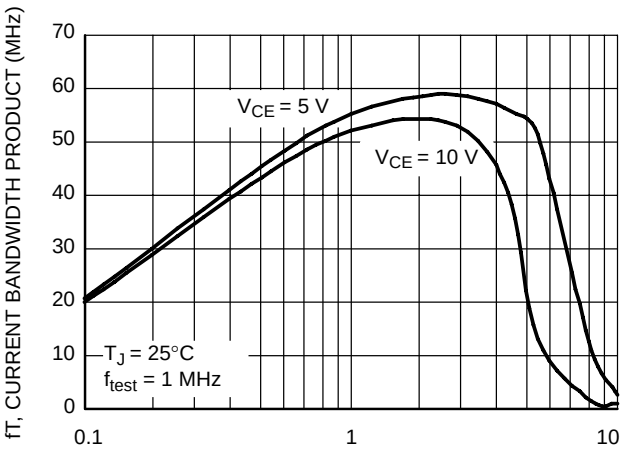



**Figure 10. Typical Current Gain Bandwidth Product, PNP NJL4302D**

## NJL4281D (NPN) NJL4302D (PNP)

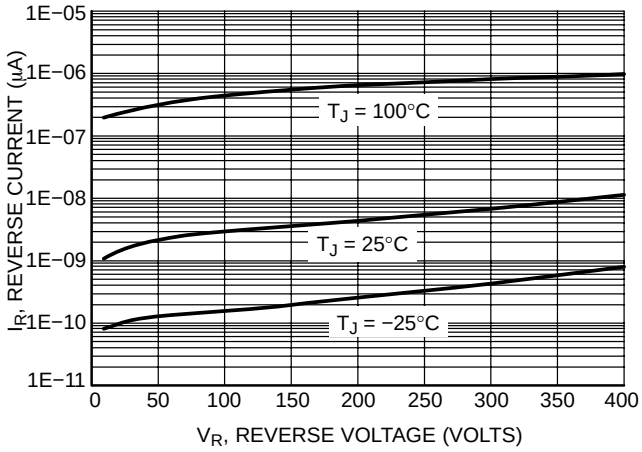



**Figure 11. Typical Diode Reverse Current**

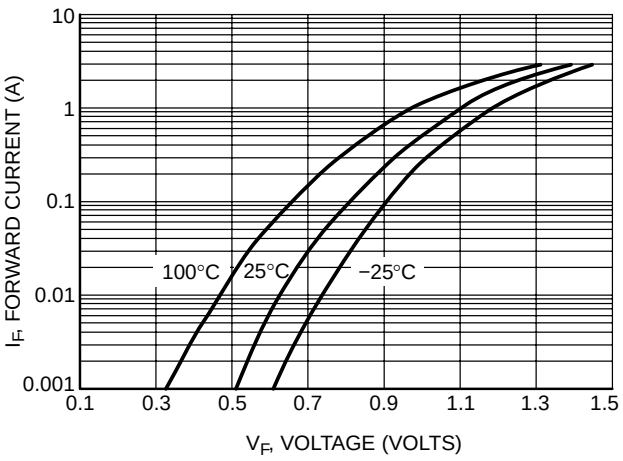



**Figure 12. Typical Diode Forward Voltage**

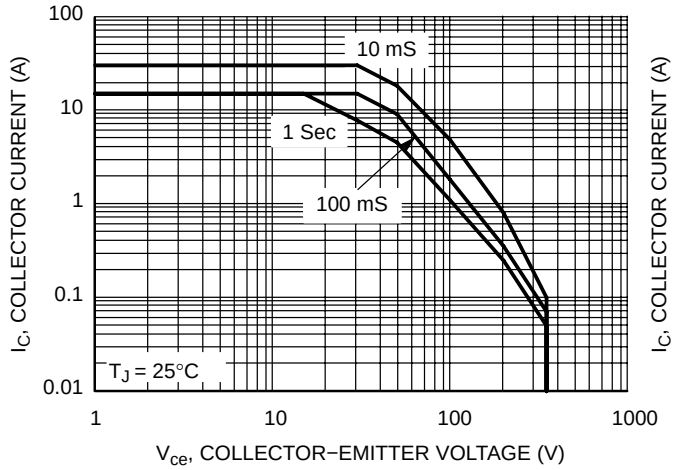



**Figure 13. Active Region Safe Operating Area, NPN NJL4281D**

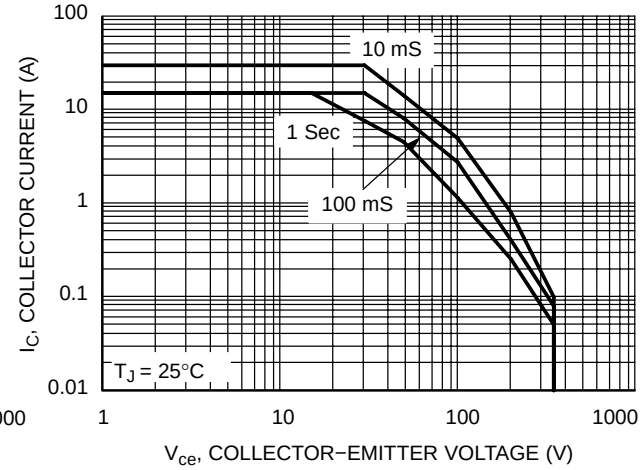
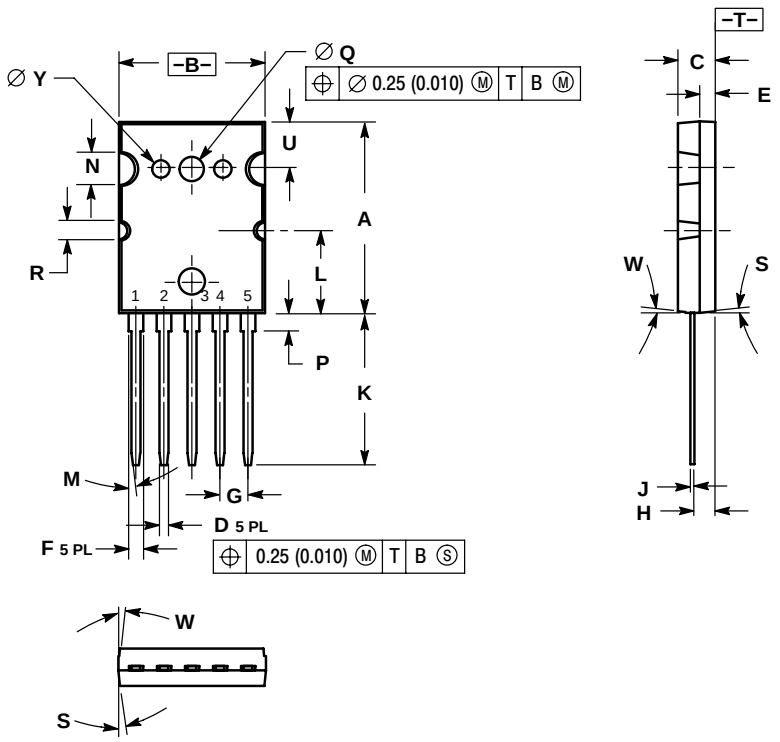



**Figure 14. Active Region Safe Operating Area, PNP NJL4302D**

# NJL4281D (NPN) NJL4302D (PNP)

## PACKAGE DIMENSIONS

**TO−264, 5 LEAD**
CASE 340AA−01
ISSUE O




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 25.857 | 25.984 | 26.111 | 1.018 | 1.023 | 1.028 |
| B | 19.761 | 19.888 | 20.015 | 0.778 | 0.783 | 0.788 |
| C | 4.928 | 5.055 | 5.182 | 0.194 | 0.199 | 0.204 |
| D | 1.219 BSC | | | 0.0480 BSC | | |
| E | 2.032 | 2.108 | 2.184 | 0.0800 | 0.0830 | 0.0860 |
| F | 1.981 BSC | | | 0.0780 BSC | | |
| G | 3.81 BSC | | | 0.150 BSC | | |
| H | 2.667 | 2.718 | 2.769 | 0.1050 | 0.1070 | 0.1090 |
| J | 0.584 BSC | | | 0.0230 BSC | | |
| K | 20.422 | 20.549 | 20.676 | 0.804 | 0.809 | 0.814 |
| L | 11.28 REF | | | 0.444 REF | | |
| M | 0 ° | −−− | 7 ° | 0 ° | −−− | 7 ° |
| N | 4.57 REF | | | 0.180 REF | | |
| P | 2.259 | 2.386 | 2.513 | 0.0889 | 0.0939 | 0.0989 |
| Q | 3.480 BSC | | | 0.1370 BSC | | |
| R | 2.54 REF | | | 0.100 REF | | |
| S | 0 ° | −−− | 8 ° | 0 ° | −−− | 8 ° |
| U | 6.17 REF | | | 0.243 REF | | |
| W | 0 ° | −−− | 6 ° | 0 ° | −−− | 6 ° |
| Y | 2.388 BSC | | | 0.0940 BSC | | |

STYLE 1:
PIN 1. BASE
2. EMITTER
3. COLLECTOR
4. ANODE
5. CATHODE



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